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Nemet

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(54) **TAMPER-PROOF QUALITY MANAGEMENT BARCODE INDICATORS**

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G01D 7/00 (2006.01)

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CPC ***G06K 19/0615*** (2013.01); ***G01D 7/005*** (2013.01); ***G06K 19/06028*** (2013.01); ***G06K 19/06046*** (2013.01)

(58) **Field of Classification Search**
USPC 235/375
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(57) **ABSTRACT**

A tamper-proof barcoded quality indicator operative to provide a machine-readable indication of exceedance of time and temperature thresholds following actuation thereof, including a first barcode including a first colorable area and being machine-readable before exceedance of the time and temperature thresholds, a second barcode including a second colorable area and not being machine-readable before exceedance of the time and temperature thresholds, a coloring agent located at a first location on the indicator, a coloring agent pathway operative to allow the coloring agent to move, at a rate which is at least partially a function of time, from the first location to the first and second colorable areas simultaneously for simultaneous coloring thereof upon exceedance of the time and temperature thresholds, thereby causing the first barcode to become unreadable and at the same time causing the second barcode to become machine-readable, and a tamper-proof actuator element operative to actuate the indicator.

7 Claims, 4 Drawing Sheets

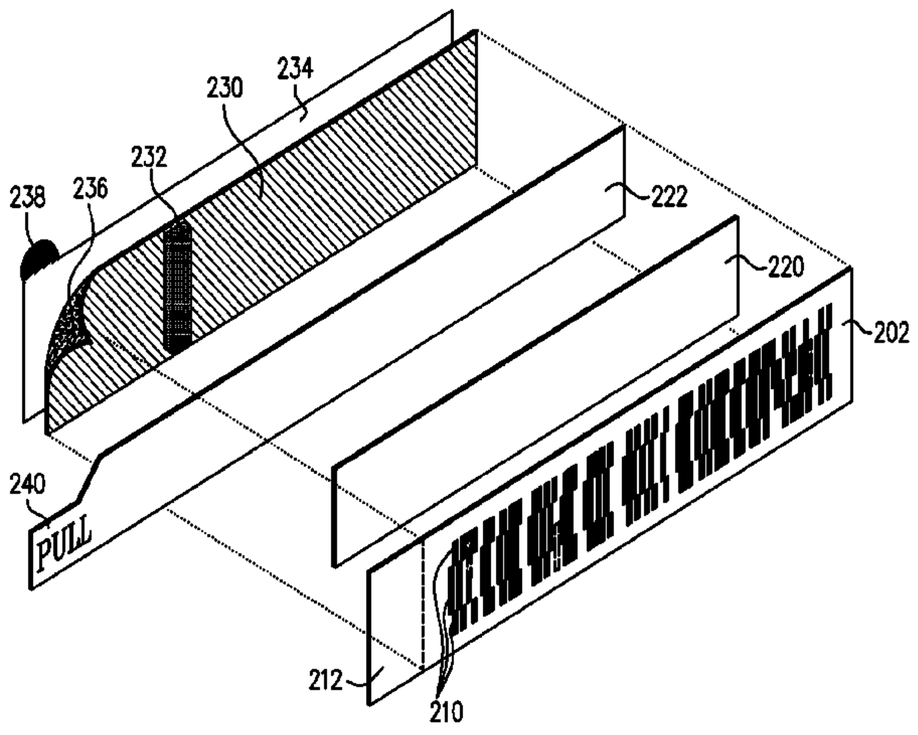

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FIG. 1

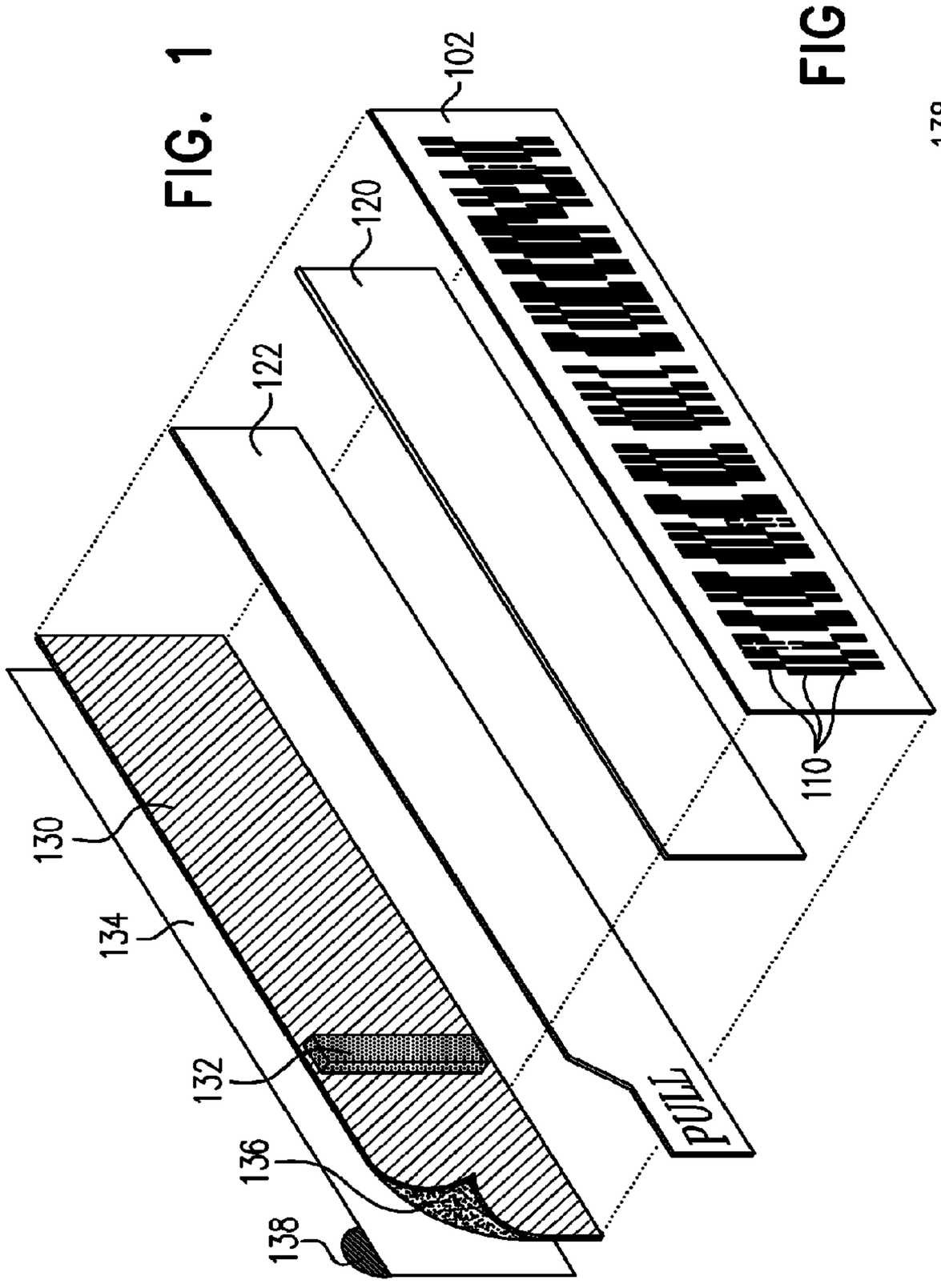
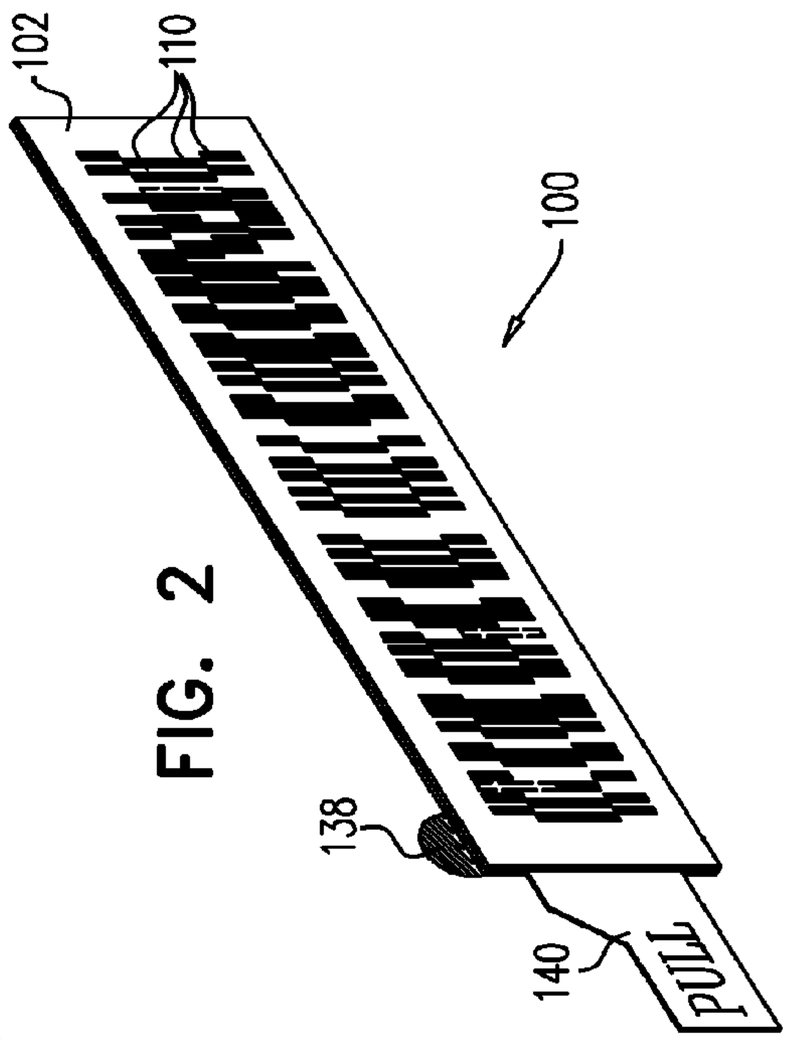

102
120
122
130
134
132
136
138
110
PULL

FIG. 2


102
110
100
138
140
PULL

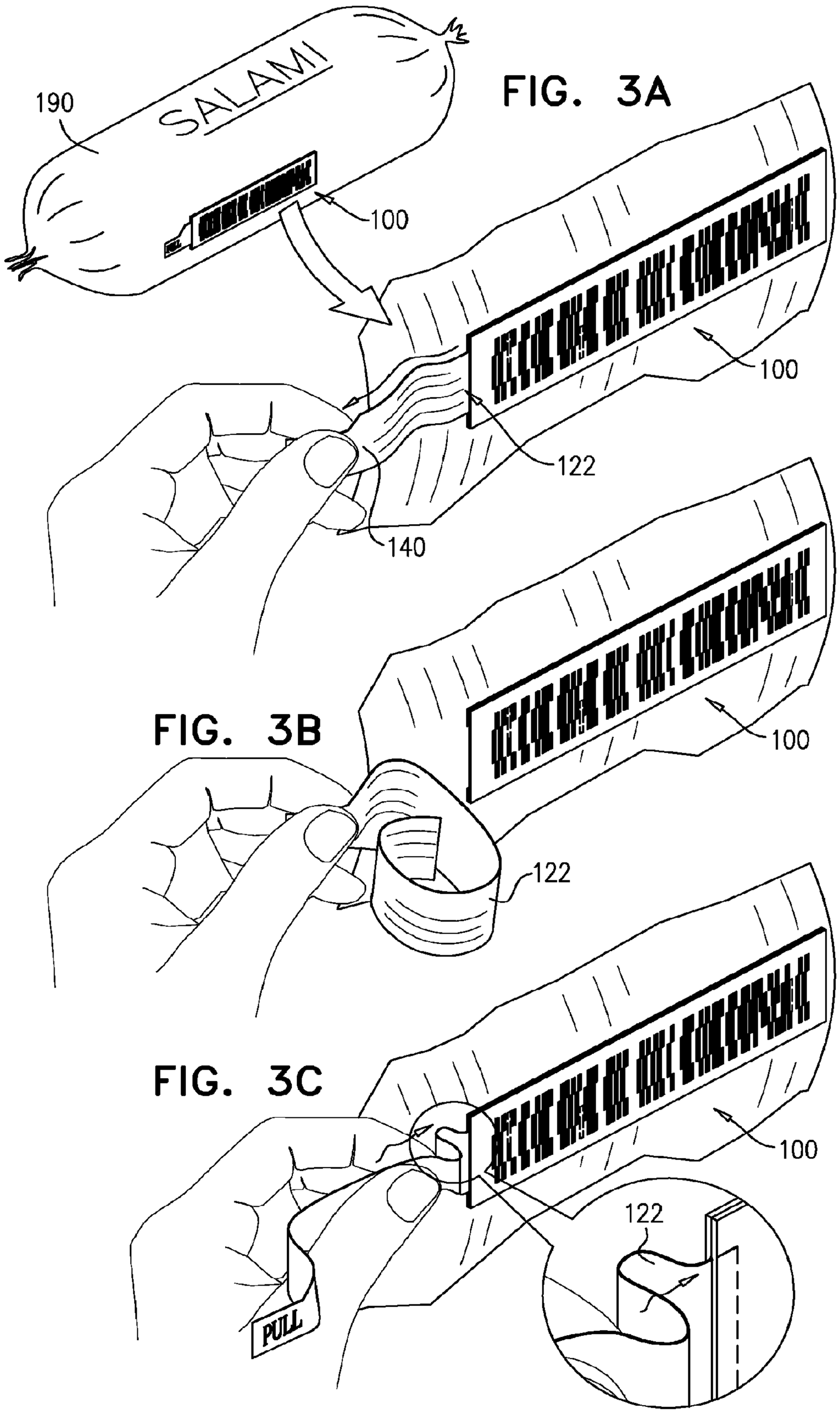


FIG. 3A

FIG. 3B

FIG. 3C

FIG. 4

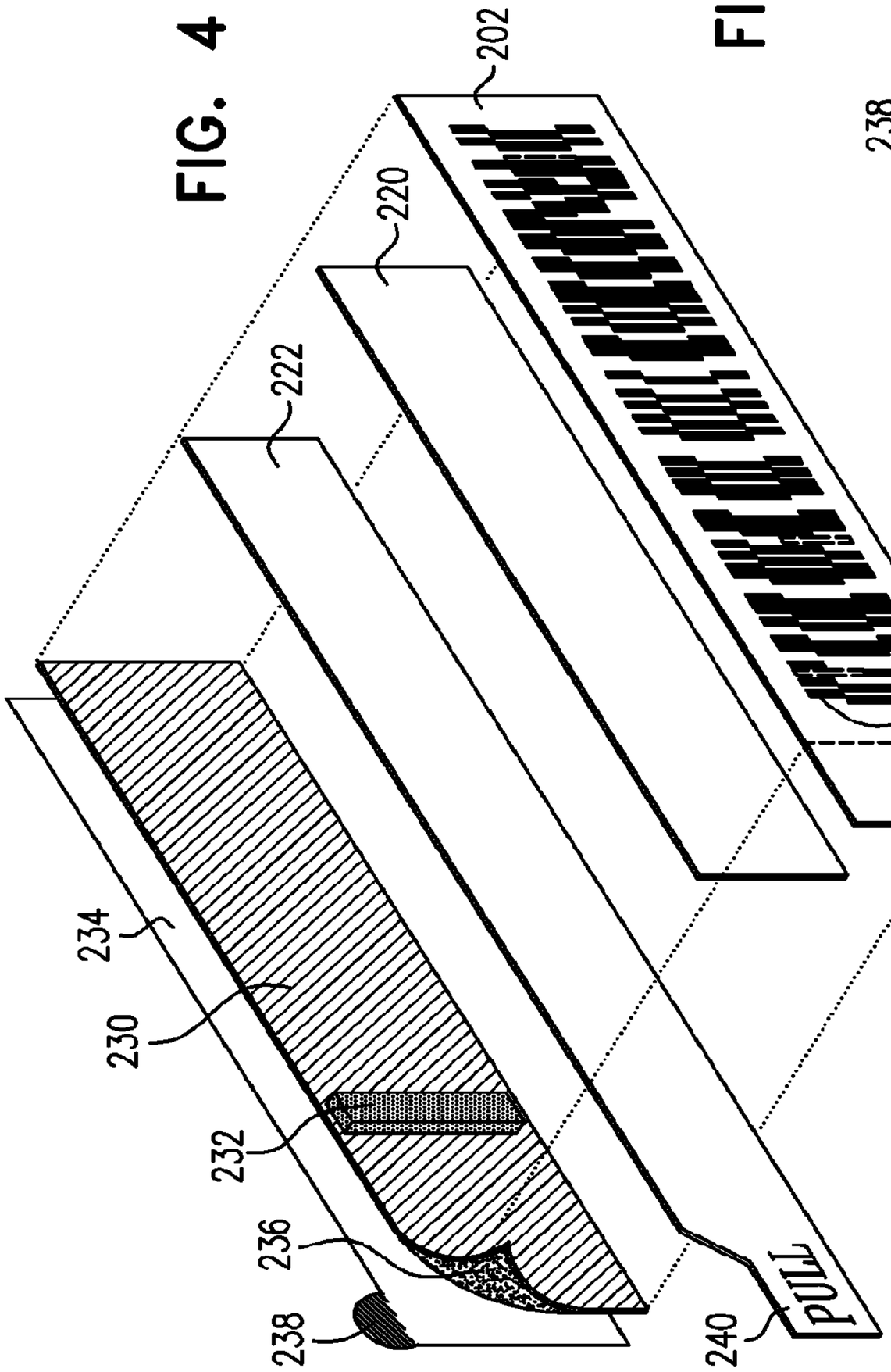
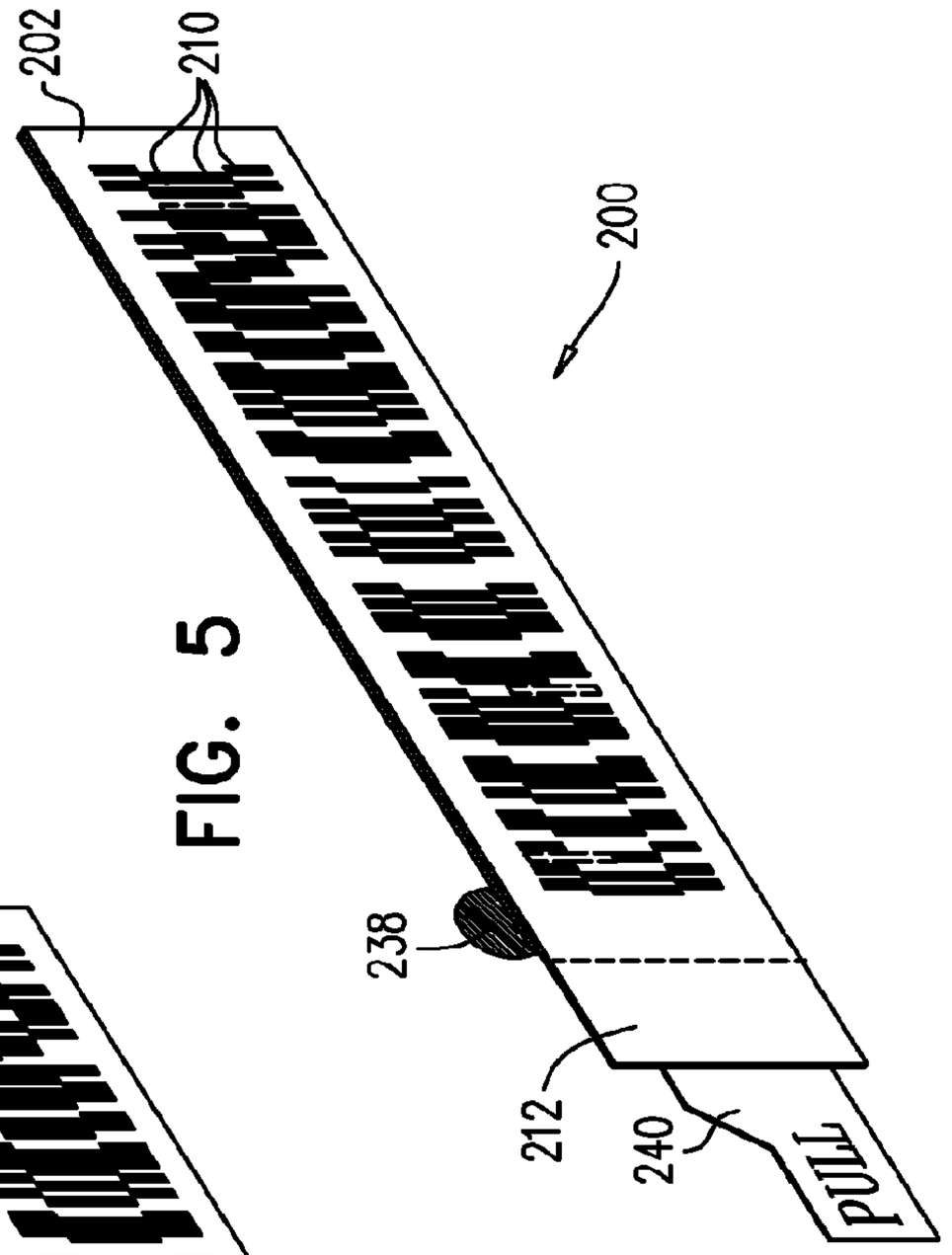

202
220
222
234
230
232
236
238
240
PULL
210
212

FIG. 5


202
210
200
238
212
240
PULL

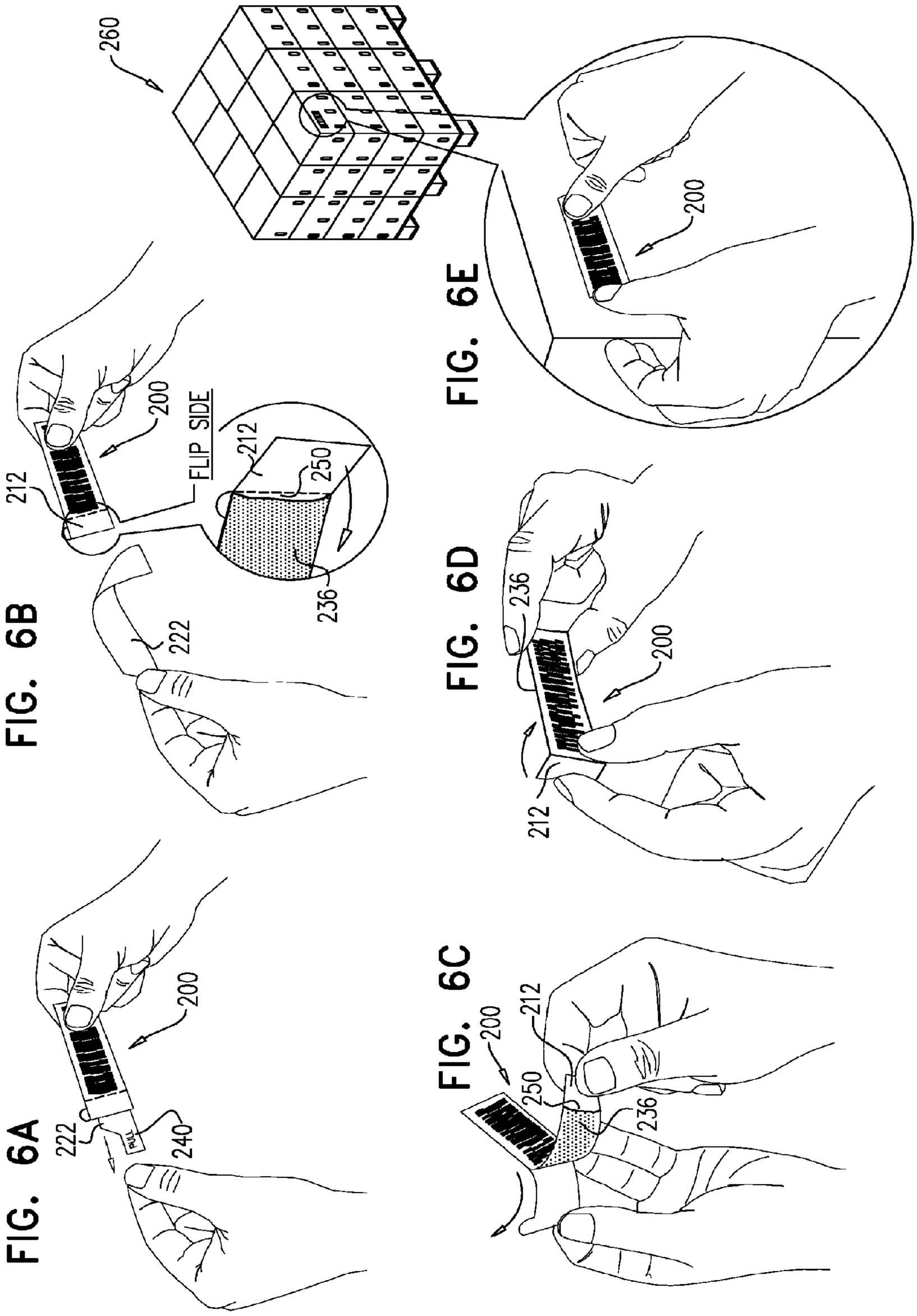


FIG. 6A

FIG. 6B

FIG. 6C

FIG. 6D

FIG. 6E

TAMPER-PROOF QUALITY MANAGEMENT BARCODE INDICATORS

REFERENCE TO RELATED APPLICATIONS

Reference is made to the following patent and patent application, owned by assignee, the disclosures of which are hereby incorporated by reference:

U.S. Pat. Nos. 7,562,811 and 8,091,776; and

U.S. Published Patent Application Nos.: 2009/0230182; 2010/0219235; 2011/0006109 and 2011/0006115; and

U.S. patent application Ser. Nos. 13/321,467; 13/321,477 and 13/323,906.

FIELD OF THE INVENTION

The present invention relates to tamper-proof quality management barcode indicators.

BACKGROUND OF THE INVENTION

The following publications are believed to represent the current state of the art:

U.S. Pat. Nos. 5,805,245; 6,009,400; 6,685,094; 6,758,397; 7,562,811; 8,091,776 and RE 39,266; and

U.S. Published Patent Application Nos.: 2009/0230182, 2010/0219235, 2011/0006109 and 2011/0006115.

SUMMARY OF THE INVENTION

The present invention seeks to provide tamper-proof quality management barcode indicators.

There is thus provided in accordance with a preferred embodiment of the present invention a tamper-proof barcoded quality indicator operative to provide a machine-readable indication of exceedance of at least one time and temperature threshold following actuation thereof, the indicator including a first barcode including at least one first colorable area, the first barcode being machine-readable before exceedance of the at least one time and temperature threshold, at least a second barcode including at least one second colorable area, the second barcode not being machine-readable before exceedance of the at least one time and temperature threshold, a coloring agent located at a first location on the indicator, a coloring agent pathway operative, following actuation of said quality indicator, to allow the coloring agent to move, at a rate which is at least partially a function of time, from the first location to the first and second colorable areas simultaneously for simultaneous coloring thereof upon exceedance of the time and temperature threshold, thereby causing the first barcode to become unreadable and at the same time causing the second barcode to become machine-readable, and a tamper-proof actuator element operative to actuate the quality indicator upon removal thereof from said quality indicator.

Preferably, the tamper-proof actuator element is disposed between the coloring agent and the coloring agent pathway prior to actuation of the quality indicator, thereby preventing passage of the coloring agent to the coloring agent pathway. Preferably, the tamper-proof actuator element is formed of a thin flexible material. Preferably, the tamper-proof actuator element includes a pullable actuator tab which protrudes from the quality indicator prior to actuation of the tamper-proof barcoded quality indicator. Preferably, the actuation of the quality indicator includes irreversibly removing the tamper-proof actuator element from the quality indicator, thereby irreversibly enabling passage of the coloring agent to the coloring agent pathway.

Preferably, the quality indicator also includes a release layer which is adhered to an adhesive back surface of the quality indicator. Preferably, removal of the release layer is operative to expose the adhesive back surface which is operable for adhering the quality indicator to a product for which quality is to be monitored. Preferably, the release layer includes a release tab operable for enabling release of the release layer from the adhesive back surface.

There is also provided in accordance with another preferred embodiment of the present invention a barcoded quality indicator operative to provide a machine-readable indication of exceedance of at least one time and temperature threshold following actuation thereof, the indicator including a first barcode including at least one first colorable area, the first barcode being machine-readable before exceedance of the at least one time and temperature threshold, at least a second barcode including at least one second colorable area, the second barcode not being machine-readable before exceedance of the at least one time and temperature threshold, a coloring agent located at a first location on the indicator, a coloring agent pathway operative, following actuation of said quality indicator, to allow the coloring agent to move, at a rate which is at least partially a function of time, from the first location to the first and second colorable areas simultaneously for simultaneous coloring thereof upon exceedance of the time and temperature threshold, thereby causing the first barcode to become unreadable and at the same time causing the second barcode to become machine-readable, an actuator element operative to actuate the quality indicator upon removal thereof from said quality indicator, and a sealing element operative to seal the coloring agent pathway subsequent to removal of the actuator element.

Preferably, the actuator element is disposed between the coloring agent and the coloring agent pathway prior to actuation of the quality indicator, thereby preventing passage of the coloring agent to the coloring agent pathway. Preferably, the actuator element includes a pullable actuator tab which protrudes from the quality indicator prior to actuation of the barcoded quality indicator. Preferably, the actuation of the quality indicator includes irreversibly removing the actuator element from the quality indicator, thereby irreversibly enabling passage of the coloring agent to the coloring agent pathway.

Preferably, the quality indicator also includes a release layer which is adhered to an adhesive back surface of the quality indicator. Preferably, removal of the release layer is operative to expose the adhesive back surface which is operable for adhering the quality indicator to a product for which quality is to be monitored. Preferably, the release layer includes a release tab operable for enabling release of the release layer from the adhesive back surface.

Preferably, the sealing element includes a sealing tab operable for foldable sealing of the coloring agent pathway. Preferably, the sealing tab is operable for selectable adherence to the adhesive back surface, thereby sealing the coloring agent pathway.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood more fully from the following detailed description, taken in conjunction with the drawings in which:

FIG. **1** is a simplified illustration of the structure of a tamper-proof barcoded quality indicator, constructed and operative in accordance with a preferred embodiment of the present invention;

FIG. **2** is a simplified illustration of the assembled tamper-proof barcoded quality indicator of FIG. **1**;

FIGS. **3**A, **3**B and **3**C are simplified pictorial illustrations of steps in the actuation of the tamper-proof barcoded quality indicator of FIGS. **1** and **2**;

FIG. **4** is a simplified illustration of the structure of a barcoded quality indicator, constructed and operative in accordance with another preferred embodiment of the present invention;

FIG. **5** is a simplified illustration of the assembled barcoded quality indicator of FIG. **4**; and

FIGS. **6**A, **6**B, **6**C, **6**D and **6**E are simplified pictorial illustrations of steps in the actuation of the barcoded quality indicator of FIGS. **4** and **5**.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Reference is now made to FIG. **1**, which is a simplified illustration of the structure of a tamper-proof barcoded quality indicator, constructed and operative in accordance with a preferred embodiment of the present invention, and to FIG. **2**, which is a simplified illustration of the assembled tamper-proof barcoded quality indicator of FIG. **1**.

The tamper-proof barcoded quality indicator of FIGS. **1** & **2** is preferably operative to provide a machine-readable indication of exceedance of at least one time and temperature threshold following actuation thereof, and includes a first barcode including at least one first colorable area, the first barcode being machine-readable before exceedance of the at least one time and temperature threshold and at least a second barcode including at least one second colorable area, the second barcode not being machine-readable before exceedance of the at least one time and temperature threshold.

Preferably, the indicator also includes a coloring agent located at a first location on the indicator and a coloring agent pathway operative to allow the coloring agent to move, at a rate which is at least partially a function of time, from the first location to the first and second colorable areas simultaneously for simultaneous coloring thereof upon exceedance of the time and temperature threshold, thereby causing the first barcode to become unreadable and at the same time causing the second barcode to become machine-readable.

A system and method for quality management which utilizes the barcoded quality indicator of FIGS. **1** & **2** is clearly described, inter alia, in U.S. Pat. No. 8,091,776 of the applicant, which is incorporated herein by reference.

It is a particular feature of this embodiment of the present invention that the tamper-proof barcoded quality indicator of FIG. **1** also includes a tamper-proof actuator element operative to prevent passage of the coloring agent to the coloring agent pathway prior to removal thereof, and to irreversibly enable passage of the coloring agent to the coloring agent pathway following removal thereof.

As shown in FIGS. **1** & **2**, tamper-proof barcoded quality indicator **100** preferably includes a barcode defining layer **102** having a multiplicity of barcodes **110** printed thereupon. Barcode defining layer **102** is preferably formed of a transparent substrate.

A coloring agent pathway **120** is preferably disposed behind barcode defining layer **102**. A tamper-proof actuator pull strip **122** is preferably disposed between coloring agent pathway **120** and a back layer **130** having a coloring element **132** mounted thereupon, which coloring element **132** preferably contains coloring agents. Tamper-proof actuator pull strip **122** preferably prevents the passage therethrough of coloring agents from coloring element **132** to coloring agent pathway **120** when quality indicator **100** in a pre-actuated state.

A release layer **134** is preferably adhered to an adhesive back surface **136** of back layer **130**. Removal of release layer is operative to expose adhesive back surface **136** which is operable for adhering quality indicator **100** to a product for which quality is to be monitored. Release layer **140** preferably includes a release tab **138** operable for easy release of release layer **140** from back surface **142**.

FIG. **2** illustrates tamper-proof barcoded quality indicator **100** in an assembled, pre-actuated state. As shown particularly in FIG. **2**, an actuator tab **140** of tamper-proof actuator pull strip **122** preferably protrudes from quality indicator **100**, between coloring agent pathway **120** and back layer **130**.

Reference is now made to FIGS. **3**A, **3**B and **3**C, which are simplified pictorial illustrations of steps in the actuation of the tamper-proof barcoded quality indicator of FIGS. **1** & **2**. As shown in FIGS. **3**A-**3**C, after affixing tamper-proof barcoded quality indicator **100** to a product **190**, indicator **100** is actuated by pulling on actuator tab **140** of tamper-proof actuator pull strip **122** and removing tamper-proof actuator pull strip **122** from between coloring agent pathway **120** and back layer **130**. It is appreciated that removal of tamper-proof actuator pull strip **122** from between coloring agent pathway **120** and back layer **130** allows the passage of coloring agents contained in coloring element **132** to coloring agent pathway **120**, thereby actuating proof barcoded quality indicator **100**.

It is appreciated that tamper-proof actuator pull strip **122** is formed of a flexible material, such as a thin paper. Therefore, as shown in particular in FIG. **3**C, it is a particular feature of this embodiment of the present invention that once removed from between coloring agent pathway **120** and back layer **130**, tamper-proof actuator pull strip **122** cannot be re-inserted between coloring agent pathway **120** and back layer **130** due to the flexible nature of tamper-proof actuator pull strip **122**, thereby preventing indicator **100** from returning to a pre-actuated state.

Reference is now made to FIG. **4**, which is a simplified illustration of the structure of a barcoded quality indicator, constructed and operative in accordance with another preferred embodiment of the present invention, and to FIG. **5**, which is a simplified illustration of the assembled barcoded quality indicator of FIG. **4**.

The barcoded quality indicator of FIGS. **4** & **5** is preferably operative to provide a machine-readable indication of exceedance of at least one time and temperature threshold following actuation thereof, and includes a first barcode including at least one first colorable area, the first barcode being machine-readable before exceedance of the at least one time and temperature threshold and at least a second barcode including at least one second colorable area, the second barcode not being machine-readable before exceedance of the at least one time and temperature threshold.

Preferably, the indicator also includes a coloring agent located at a first location on the indicator and a coloring agent pathway operative to allow the coloring agent to move, at a rate which is at least partially a function of time, from the first location to the first and second colorable areas simultaneously for simultaneous coloring thereof upon exceedance of the time and temperature threshold, thereby causing the first barcode to become unreadable and at the same time causing the second barcode to become machine-readable.

A system and method for quality management which utilizes the barcoded quality indicator of FIGS. **4** & **5** is clearly described, inter alia, in U.S. Pat. No. 8,091,776 of the applicant, which is incorporated herein by reference.

Preferably, the barcoded quality indicator of FIGS. **4** and **5** also includes an actuator element operative to prevent passage of the coloring agent to the coloring agent pathway prior to removal thereof, and to irreversibly enable passage of the coloring agent to the coloring agent pathway following removal thereof.

It is a particular feature of this embodiment of the present invention that the barcoded quality indicator of FIGS. **4** and **5** also includes a sealing element operative to seal the coloring agent pathway subsequent to removal of the actuator element.

As shown in FIGS. **4** & **5**, barcoded quality indicator **200** preferably includes a barcode defining layer **202** having a multiplicity of barcodes **210** printed thereupon. Barcode defining layer **202** is preferably formed of a transparent substrate, and is preferably formed with a foldable sealing tab **212**.

A coloring agent pathway **220** is preferably disposed behind barcode defining layer **202**. An actuator pull strip **222** is preferably disposed between coloring agent pathway **220** and a back layer **230** having a coloring element **232** mounted thereupon, which coloring element **232** preferably contains coloring agents. Actuator pull strip **222** preferably prevents the passage therethrough of coloring agents from coloring element **232** to coloring agent pathway **220** when quality indicator **200** in a pre-actuated state.

A release layer **234** is preferably adhered to an adhesive back surface **236** of back layer **230**. Removal of release layer is operative to expose adhesive back surface **236** which is operable for adhering quality indicator **200** to a product for which quality is to be monitored. Release layer **234** preferably includes a release tab **238** operable for easy release of release layer **234** from back surface **236**.

FIG. **5** illustrates barcoded quality indicator **200** in an assembled, pre-actuated state. As shown particularly in FIG. **5**, an actuator tab **240** of actuator pull strip **222** preferably protrudes from quality indicator **200**, between coloring agent pathway **220** and back layer **230**.

Reference is now made to FIGS. **6**A, **6**B, **6**C, **6**D and **6**E, which are simplified pictorial illustrations of steps in the actuation of the barcoded quality indicator of FIGS. **4** and **5**. As shown in FIGS. **6**A & **6**B, indicator **200** is actuated by pulling on actuator tab **240** of actuator pull strip **222** and removing actuator pull strip **222** from between coloring agent pathway **220** and back layer **230**. It is appreciated that removal of actuator pull strip **222** from between coloring agent pathway **220** and back layer **230** allows the passage of coloring agents contained in coloring element **232** to coloring agent pathway **220**, thereby actuating proof barcoded quality indicator **200**. It is also appreciated that removal of actuator pull strip **222** from between coloring agent pathway **220** and back layer **230** is operative to expose an open slit **250** formed between coloring agent pathway **220** and back layer **230**.

Thereafter, as shown in FIG. **6**C, release layer **234** is removed from adhesive back surface **236**, thereby exposing adhesive back surface **236** which is operable for adhering quality indicator **200** to a pallet of produce **260** for which quality is to be monitored. Thereafter, as shown in FIG. **6**D, slit **250** is sealed by folding foldable sealing tab **212** over slit **250** and adhering tab **212** to adhesive back surface **236**.

It is a particular feature of this embodiment of the present invention that sealing of slit **250** by folding sealing tab **212** over slit **250** onto adhesive back surface **236** is operative to prevent environmental elements, such as moisture, from entering slit **250**. It is appreciated that entry of moisture into slit **250** may damage, for example, any one of barcode defining layer **202**, barcodes **210**, and coloring agents contained in coloring element **232** or located in coloring agent pathway **220**, thereby rendering quality indicator **200** inaccurate.

As shown in FIG. **6**E, after sealing of slit **250**, indicator **200** is adhered to pallet **260**.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described hereinabove. Rather the scope of the present invention includes both combinations and subcombinations of various features described hereinabove and variations and modifications thereof which would occur to persons skilled in the art upon reading the foregoing, which are not in the prior art.

The invention claimed is:

1. A barcoded quality indicator operative to provide a machine-readable indication of exceedance of at least one threshold following actuation thereof, said indicator comprising:

a first barcode including at least one first colorable area, said first barcode being machine-readable before exceedance of said at least one threshold;

at least a second barcode including at least one second colorable area, said second barcode not being machine-readable before exceedance of said at least one threshold;

a coloring agent located at a first location on said indicator;

a coloring agent pathway operative, following actuation of said quality indicator, to allow said coloring agent to move from said first location to said first and second colorable areas simultaneously for simultaneous coloring thereof upon exceedance of said threshold, thereby causing said first barcode to become unreadable and at the same time causing said second barcode to become machine-readable;

an actuator element operative to actuate said quality indicator upon removal thereof from said quality indicator; and

a sealing element operative to seal said coloring agent pathway subsequent to removal of said actuator element, said sealing element comprising a foldable sealing tab operative to prevent damage to said barcoded quality indicator.

2. A barcoded quality indicator according to claim **1** and wherein said actuator element is disposed between said coloring agent and said coloring agent pathway prior to actuation of said quality indicator, thereby preventing passage of said coloring agent to said coloring agent pathway.

3. A barcoded quality indicator according to claim **1** and wherein said actuator element comprises a pullable actuator tab which protrudes from said quality indicator prior to actuation of said barcoded quality indicator.

4. A barcoded quality indicator according to claim **1** and wherein said actuation of said quality indicator comprises irreversibly removing said actuator element from said quality indicator, thereby irreversibly enabling passage of said coloring agent to said coloring agent pathway.

5. A barcoded quality indicator according to claim **1** and wherein said quality indicator also comprises a release layer which is adhered to an adhesive back surface of said quality indicator.

6. A barcoded quality indicator according to claim **5** and wherein removal of said release layer is operative to expose said adhesive back surface which is operable for adhering said quality indicator to a product for which quality is to be monitored.

7. A barcoded quality indicator according to claim **5** and wherein said release layer comprises a release tab operable for enabling release of said release layer from said adhesive back surface.

* * * * *